



# LEARNING & THINKING STYLES AND THEIR EFFECT ON THE DESIGN PROCESS IN ARCHITECTURE STUDIO

Ar. Anupama Chawla

Architect and Academician, New Delhi.

## ABSTRACT

Architectural Education is a combination of myriad exposures, factual learning, cognitive endeavors and corrective guidance by esteemed faculties. In this age of technical and electronic revolution, the student just needs a small light to flare to a beacon. He has technology at the flick of a button and global knowledge at his fingertips. A student has a particular approach to design thinking or the creative process. Often these approaches are linked to his learning and thinking style. Learning styles is his preferred method to receive information. Design approach also showcases his thinking style. Thinking style is his preferred way to process the information he receives. However varied the experiences and backgrounds of architecture students may be, their thinking styles may match according to the nature of the design project. Hence thinking styles and learning styles may/may not be linked but they are definitely linked to their individual design processes.

This Paper sets out to explore how the learning and thinking styles of an individual effects his/her design process in the architecture studio. Firstly, the Honey and Mumford learning style questionnaire (for Activists, reflectors, Pragmatists and Theorists) was tested on a random sampling of 10 students each from the first, second and third years of B.Arch. at Jamia Millia Islamia ( Department of Architecture, Faculty of Architecture and Ekistics, New Delhi) and a comparison was drawn amongst the freshmen and seniors. Secondly, the Shortened Version of the Sternberg thinking styles Inventory (40 ques) for functions (Legislative, executive, Judicial) and levels (global and local) of thinking styles, was conducted on these students. The current on-going design Problem was extensively studied and mapped onto these learning and thinking styles tests, using Rasmussen design process. The performance of the students was correlated with their learning and thinking abilities and a satisfactory conclusion was drawn. Further, a studio pedagogical approach is defined to accommodate the various learning and thinking styles in the architecture design studio. It is hoped that by knowing how our students think and learn, educators and professors are able to conduct their studios far better than by assumptions.

**KEYWORDS:** Learning styles, thinking styles, Studio Pedagogy, design process, Architecture Education.

## MOTIVATION FOR RESEARCH:

In a study conducted in 2016 by the Author, on design inspirations on 3rd year students it was discovered that the stages in every students design process are not the same. To get at the same goal, their thinking approaches are different. Design process as defined by Graham Wallas, has 5 steps- Preparation, Incubation, Illumination, Evaluation, revision. Preparation is the stage where the person prepares for the creative process by research and detailed collection of facts about the design problem and related data. Incubation is the second stage of the creative process wherein the person mulls over the options and design possibilities hence possible. He may leave the design problem for a bit and then come back to it refreshed. Illumination is that "A-Ha" moment when the person gets insight in to the correct and appropriate solution to the design problem. Evaluation is the assessing of the appropriateness by the person whether the solution is a correct fit. Revision is the stage where the person goes over his design problem and changes his stance if so needed.

In an average architecture studio, there may be all the different types of learners and thinkers, and it is up to the instructor's dedication and commitment to cater to all types and ensure class performance. This Design submission process is created by the instructors to ensure a smooth design product. Hence all types of stages of different design studio approaches (Dr. Ashraf Salama, 1999) are there to cover different types of assignments and submissions for the end result- The design project. This study will try to find the relationship between learning style and thinking style and their effect on the individual design process.

## INTRODUCTION:

Design studio process is quite important in design education since it is the core of the curriculum and all the courses taught in design education are related to the design studio (Smith, D M and Kolb). The medium of instruction in the design studio is open giving and receiving of Information of various type such as factual, theoretical, practical, conceptual and scientific. These forms of information transfer are to facilitate the basic goal of the architecture studio- the design process and the design product. Since there is a free discussion of the students' design with presentation and desk critique, it is obvious that the reception of content may not be equal to all students and their learning styles may hinder a uniform understanding. Design theory is a mere supplement to the cognitive processes of the student. His design thinking may/ may not be in tandem with the approach of the instructors hence there is a fair ratio of the instructors to the students. Design studio offers an atmosphere that is conducive to a free exchange of ideas through an information processing which may be considered as an organizational and social process for both the students and the instructors. Design serves as a mediator between mental activity (invention) and social activity (realization) (O.O. Demirbas, and H. Demirkan).

Different people learn (receive information) differently and different people think (Process information) differently. Hence the basic design process taught

and fostered in design studios may not be conducive to the learning and thinking abilities of the students, since it is same for all. When the demands of the design process are different at different stages, can the thinking and learning styles of different students help the students to get their peak performances of the design process?

## LITERATURE STUDY:

### Introduction to Learning styles:

Learning is defined as the way a student receives some information or knowledge. This learning can be done in structured formal way as in a class room from a teacher and a proper syllabus or it can be in an informal way in many informal ways without the structure of a teacher, classroom, syllabus, tests. Within the formal education system also there are various types of subjects and curriculum that need special environments and instruction styles. One of these is the architecture stream of education wherein the studio is of the prime importance. The atmosphere created in the studio and the way instruction is imparted is of prime consideration because creativity can only be fostered if the learning and the understanding are stimulus enough. In general, the architectural curriculum is composed of fundamental courses that develop design knowledge; technology based courses that develop scientific formation of architecture; arts based courses for strengthening architectural expression; and, finally the design courses, being a combination of the former three and constitute the most crucial part of design education.

Learning style of the students are varied and layered. A learning style may be the in-born capability with which the student will receive the information given to him. This is not to be confused with ability. This is his inherent choice to receive the information. Many researchers have done a lot of research on learning styles. Most frequently used learning style models are the Honey and Mumford Learning style, Felder-Silverman Learning Style Model and Kolb's Learning Style Inventory (LSI). Although all the styles classify different learning types in different manners, their aim and approach are similar.

### Researches on Learning Styles:

- Kolb's Experiential Learning Theory:* Experiential learning theory considers learning as a cycle that begins with experience, continues with reflection and later leads to action that becomes a concrete experience for reflection. There are four stages of experiential learning model- Concrete Experience, Reflective Observation, Abstract conceptualization and Active experimentation. Kolb suggested that an individual learner's style may be identified by assessing her/his position on each of the bipolar dimensions by using a test called learning styles inventory (LSI) 25. There are 12 open-ended questions that have four different alternative responses in LSI. Each question asks respondents to rank-order four sentence endings in a way that best describe their learning preference in any learning setting. After answering all 12 questions, by using the key of the test, four scores are calculated.

- b) *Learning styles questionnaire by Honey and Mumford*: Learning styles were developed by Peter Honey and Alan Mumford, based upon the work of Kolb, and they identified four distinct learning styles or preferences: Activist, Theorist; Pragmatist and Reflector. These are the learning approaches that individuals naturally prefer and they recommend that in order to maximize one's own personal learning

Honey and Mumford (1986) adopted Kolb's model and created their own version to suit middle or senior managers in business. Two variations were created to the original model to address the business environment. Firstly, the authors renamed the stages as having an experience, reviewing the experience, concluding from the experience, planning the next steps.

Secondly, as per stages they have renamed the learning style as activist, reflector, theorist and pragmatist. Based on the learning style they developed Learning Styles Questionnaire (LSQ) (Honey & Mumford 1986). This questionnaire was developed as self-development tool. The completion of the question helps the managers to focus on strengthening the underutilized styles so that everyday learning experience can be enhanced.

In 1988, Hayes and Allinson, conducted a factor analysis of many learning style questionnaires and found that LSQ (Honey and Mumford) was the most reliable.

### Introduction to Thinking styles:

A thinking style is a characteristic way of processing information. It involves how one acquires knowledge, organizes thoughts, forms views and opinions, applies values, solves problems, makes decisions, plans, and expresses one's ideas to others. A lot of people do work that they are educated for or have qualified for. But this does not mean that they are best suited for the job or task and can excel in it. Also we may have to do a number of tasks at the same time which we are not best suited for. For example we may use our right hand for writing, eating, opening keys, shaking hands etc. but a right handed person also does a lot of left-handed things which he/she may do instinctively or for which the left side is more comfortable. However if required the person may train his left hand to do a task which was usually done by the right. Similarly a person may be more focused on the details of the task rather than the over view when it is not required but because it is his natural style. This may result in loss of time and energy. Similarly, a person may like to gather the theory about a task rather than simply go for the work at hand when time is short and land up creating a professional mess. Hence the focus and orientation of one's thinking has to be according to the task at hand and time in hand. It is for the person to hone his weaker talents and nurture his instinctive style according to the situation.

### Researches on thinking Styles:

- a) *Hermann Whole Brain Dominance*: Dr. Roger Sperry, who was awarded the Nobel Prize in 1981, said that the human brain is divided into 2 parts- Left brain and Right Brain. The left brain according to Dr. Sperry was the logical, Sequential, analytical, objective side of the person which looked at parts. The right brain of the person was the random, intuitive, holistic, synthesizing, subjective part of the brain which looked at the whole picture. Language and word skills are from the left side of the brain whereas, shapes, music, reading faces are from the right side of the brain. William Herrmann further developed this 2 parts of brain to 4 parts of the brain such as: A: analytical, B: sequential, C: Interpersonal and D: Imaginative thinking.
- b) *Sternberg-Zhang Thinking styles inventory*: Just like a state government has Forms, Functions, Scope, levels and Leanings, Sternberg's theory of thinking styles hinges on the fact that each person has his own style of mental self-government. These are of 13 categories. Functions such as Legislative, Executive, Judicial; Forms such as Monarchic, Hierarchic, Oligarchic, Anarchic; Level such as Global and local; scope that is external and internal and leanings such as Liberal or conservative.

#### 1). Functions:

- a) *Legislative*: Prefer creating their own ways of doing things and deciding for themselves what they will do and how they will do it. Like to create their own rules.
- b) *Executive*: Prefer pre-structured or prefabricated rules and problems.
- c) *Judicial*: Like to evaluate rules and procedures. Prefer problems involving analyses and evaluations of existing objects and ideas.

#### 2. Forms:

- 1) *Monarchic*: These people perform best when goals are singular. They deal best with one goal or need at a time.
- 2) *Hierarchic*: These people can focus on multiple goals at once and recognize that all goals cannot be fulfilled equally. These people can prioritize goals easily.
- 3) *Oligarchic*: These people deal well with goals that are of equal weight, but they have difficulty prioritizing goals of different weight.

- 4) *Anarchic*: These people depart from form and precedent. Often they don't like or understand the need for rules and regulations. They operate without rules or structure, creating their own problem-solving techniques with insights that often easily break existing mindsets.

#### 3. Scope:

- 1) *Global*: Prefer dealing with relatively larger and more abstract issues. Tend to ignore or dislike details in favor of "seeing the forest rather than the trees."
- 2) *Local-Like*: concrete problems rich in detail. More oriented toward pragmatics, and prefer "seeing trees rather than the forest."

#### 4. Levels:

*Internal*: Like to be by themselves

*External*: Like to collaborate and work in groups

#### 5. Leanings:

*Liberal*: Likes to do things in new ways, defy conventions

*Conservative*: Likes to do things in tried and true ways, follow conventions

Despite much criticism, Sternberg's theory of mental self-government, is found to be most reliable and extensive.

### Introduction to Design Process:

Design Process, like any other process is actually a 3 step process: Input, Process, Output wherein the process has in-built steps like Analysis and synthesis. When consciously solving problems, or when creatively involved in the activity of design. Two basic stages are necessary, first we break the situation into parts for examination (analysis) and then we reassemble the situation based on our understanding of improvements discovered in our study (synthesis)-Koberg

- a) *Koberg and Bagnell*: "While comparing many problem solving approaches, it becomes necessary to search for their basic abstractions or their common denominators," write Koberg and Bagnell (1972). They started out as defining the design process as simple 3 step process - *Input- Process- Output*.

Then the Process was expanded into analysis and synthesis, with definition coming in between. Further synthesis was expanded into ideation, idea selection and implementation. Evaluation was added later after implement.

So Finally, Koberg and Bagnell expanded this process into a 7 step process as

**Accept - Analyze - Define - Ideate - Select - Implement - Evaluate**

(Koberg and Bagnall wrote The All New Universal Traveler in 1972, and presented a circular, seven-step process to problem-solving.)

- b) *Jones*: From the renaissance to the 1950s, design was generally done by individuals. A patron submitted a "brief" to a designer who produced a solution to the given problem by a method which is now dubbed the "black box" method. As the name suggests, the process of design itself was not visible to anyone but the designer, and sometimes he didn't really know how he discovered the solution himself. Nor could he always give you the rationale behind every choice made in the design.

The first steps to bringing the process of designing out of the black box and into the realm of conscious group effort occurred in the twentieth century, were by Jones who defined design as design by drawing becomes a tool for solving a sub-problem, an element of a system which is too large for one person to complete. The three step process was *Divergence -Transformation - Convergence*.

He proposed a Mathematical method of breaking down a set of design requirements into 10 reasonably independent sub-sets. Physical components designed to match such sub-sets will not interfere with each other. This absence of conflict between different Parts of the design is intended to increase the possibility of subsequent modification, adaptation and change. The design problem is divided into pieces each of which is solved on its own without reference to the overall design into which the pieces are afterwards combined.

- c) *Alex Osborne and Sidney Parnes (1976) Creative Problem solving*: Alex Osborne was a part of the advertising firm, Batten, Barton, Durstine and Osborn (BBD&O). In 1953, Alex Osborne (father of brainstorming) wrote a book titled "Applied Imagination: Principles and Procedures of Creative Problem-Solving." He was one of the first – if not the first – to write about the practical application of brainstorming and creative problem-solving (CPS). Here is how he outlines the CPS process...The creative problem-solving process ideally comprises these procedures: (1) Fact-finding. (2) Idea-finding. (3) Solution-finding.

Osborne-Parnes stages of Creative Problem solving were Fact Finding, Idea Finding, Solution Finding- divided into 3 stages: which were further divided into 2 parts each- Problem definition, Preparation, Idea production, Idea development, Evaluation and adoption. He also stressed on using the creative and judicial judgment for creative problem solving. This involves the separation of imaginative and judicial judgment, and the principle of suspending judgment.

#### Stages of Design Process:

Vitruvius (cited by Lang, 1987, p. 37), has stated: "architectural designing is the process of selecting parts to achieve a whole". Descartes (1637) had his own set of ideas for structuring his own creative efforts in his Discourse on method. Following Descartes, architects such as Laugier (1753) described the process of designing as one of decomposing a problem, solving the components, and then synthesizing the partial solutions into whole ones. For Le Corbusier, it was a decomposition/ composition stated in 'Vers une architecture', formulation of the problem in terms of the function to be housed and design standards and composition of these into built form.

In today's world with the advent of many specialists into the designing and making of a building, a stage wise approach is followed wherein after one stage is over the next one begins. Professor Broadbent 1973 in his comprehensive book on Design in Architecture states, "By the early 1960s. system engineering, ergonomics, operational research, information theory and cybernetics , not to mention the new maths and computing were all available to the design theorist in highly developed forms, and influenced the emergence of design methods"(Broadbent 1973).

1) *Asimow's Model 1962*: He divided the steps and stages which the architectural design process passes through into (RIBA handbook, 1973): Primary Needs, Feasibility Study, Preliminary Design, Detailed Design, Planning for Production, Planning for distribution, Consumption Planning, and Project Delivery.

2) *RIBA's Model*: Royal Institute of British Architecture decided and stated that the design process consists of twelve steps which categorized into four main stages (RIBA, 1967):

- Briefing (Inception - Feasibility Study)
- Sketch Planning (Outline Proposal - Scheme Design)
- Working Drawing (Detailed Design - Production Of Information - Bill Of Quantities - Tender Action)
- Site Operation (Project Planning - Operation On Site – Completion - Feed Back)

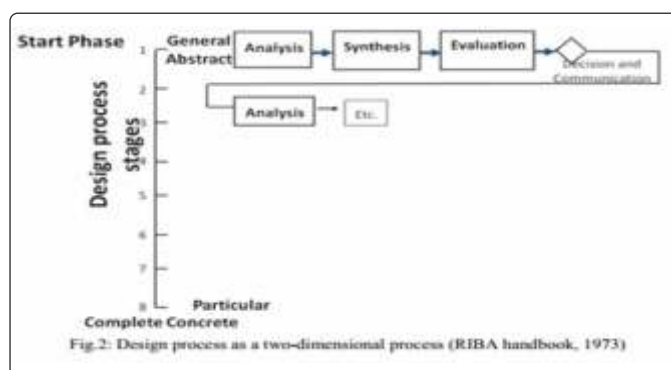


Fig 1. The RIBA 2 dimensional Design Process

Image courtesy: Dr. Eman Sabry Abdellatif Abo Wardah, and Dr. Manal Osama Khalil; Design Process & Strategic Thinking in Architecture

3) *Rasmussen design process stages*: Rasmussen was trained in electrical and control engineering and much of his work reflects that engineering training. His greatest achievements are in integrating human factors and engineering and applying the resulting ideas to safety. Systems theory first arose in the 1940s and 1950s as a reaction to the changes in engineering that were starting to appear at that time. The most important change was in the complexity of the systems people were building. As complexity increased, traditional engineering approaches to system design and analysis became less and less effective. The strategy is basically to handle complex systems by (1) dividing the system into distinct parts for analysis, (2) examining the parts separately, and later (3) combining the separate analysis results to provide results for the system as a whole. The physical aspects are divided into physical components, the functional aspects into functional components, and behavior is treated as distinct events over time.

Rasmussen said that if a complex problem is to be solved it has to be divided into smaller phases to solve each phase in parts and then collect the part solutions to form the overall picture. This is the systems approach used in engineering and IT industries. The systems approach applied by Rasmussen in 1990 showed a better way of breaking up the design process into smaller components and study the process in whole to parts methods with division of the functions into Abstract intentions, Abstract functions, General functions, Physical Functions, and concrete shape. Basically the phases go from Abstract to concrete on the Y-axis and from general to details on the x-axis.

The framework that is described here begins with the description of the design context in terms of a design constraint space. Figure 1 shows the two dimensional constraint space. Horizontally, different domains involved in the design problem are represented. Vertically, the space is divided into levels of abstraction.

#### Constraints:

- 1) **Abstract Intentions**: This is the overall view of the design problem; Aim of the problem that is what does it intend to do/solve. These are the overall goals of the design problem.
- 2) **Functional Intentions**: These are the "how to" constraints or the means by which the objectives will be met.
- 3) **General functions**: This is entirety of the design goals. In many cases, these processes represent criteria by which the design is adjudged to ensure it is meeting the design goals.
- 4) **Physical Functions**: this represents the physical constraints by which the functions will be satisfied and the parameters which are determined by all the domains.
- 5) **Concrete shape**: This is the final product which is formed after the constraints are met. This is also shared across all domains and is affected by them.

An example of a design process:

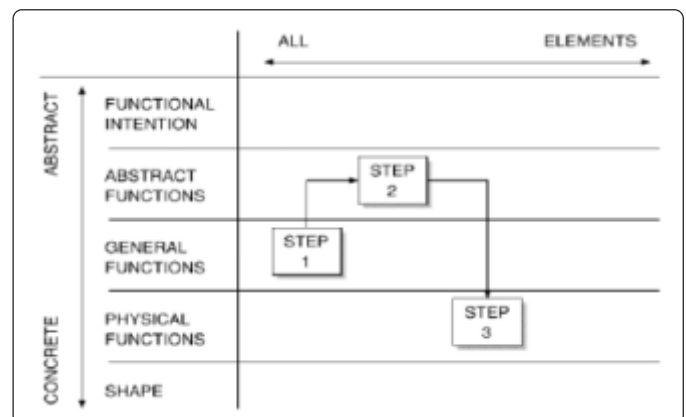


Fig 2. Rasmussen design Process

Image courtesy- O.O. Demirbas, and H. Demirkan; "Focus on architectural design process through learning styles"

#### Collection of Data- Case Studies:

The author has taken a random sampling of 10 students each from 1st, 2nd and 3rd years of B.Arch. Jamia Millia Islamia, New Delhi (30 students in all) She then conducted 1) the Honey and Mumford Learning styles Questionnaire on them (for Activists, Reflectors, Pragmatist, Theorists) Graded traditionally and 2) made them take the Shortened Version of the Sternberg thinking styles Inventory (40 ques) for functions (Legislative, executive, Judicial) and scope( global and local) of thinking styles, also graded as per the TSI. Honey and Mumford LSQ consists of 80 random personal statements which have to be agreed upon or disagreed with by the contestant. The thinking style questionnaire was Sternberg/Zhang and only the functions and scope were tested. This simplification was on the account of the other categories not being applicable to architecture design.

She then studied their current design problem in architecture studio and mapped the data using Rasmussen design process. The students design process has been studied over 3-4 submissions according to the class progress, alongwith personal interviews (one to one) of the students. The grading has also been done by the internal faculties involved in each class for a fair mapping of the process over 5 months of a semester.

The design problem for the first year architecture students, comprised of 3 short design assignments- 1) Toilet design, area approx. 2400mm x 1800mm, 2)



Design for entry gate at Jamia (redesign Gate no.2), requiring-2 gates of 3 m each for vehicles and for pedestrians, Guard room with access to a toilet. 3) Kitchen Design, area: 5105mm x 3124mm.

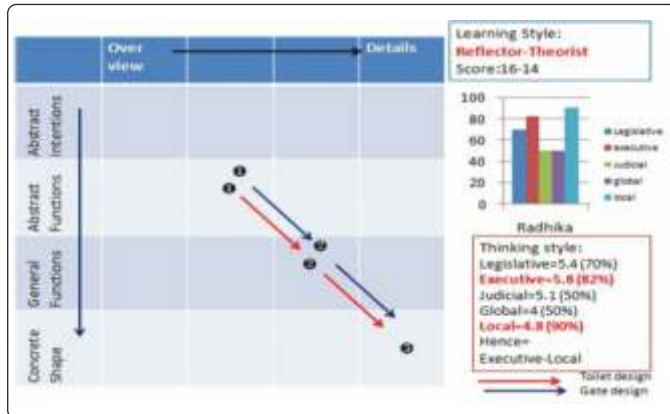


Fig 3: Sample study of a first year student and Summary of 1<sup>st</sup> year students

The Second Year architecture students had a single design problem to design a Resort Building in Diu, Gujarat, India. The Design Intent was- 1) To Design as per Vernacular Architecture of Diu. 2) Design with the perspective of the user community in Diu.

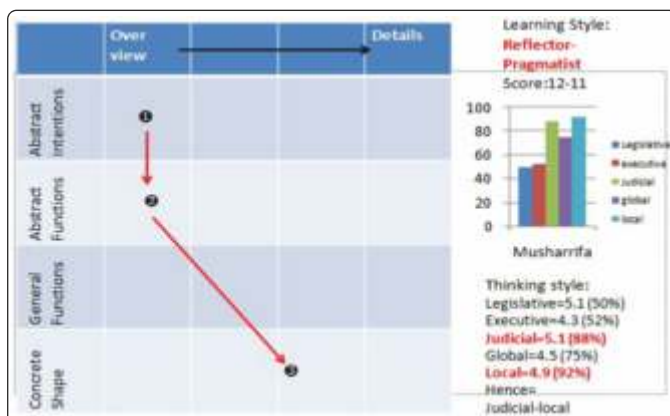


Fig 4: Sample student study- second year and Summary of 2<sup>nd</sup> year students

The design problem for the third year architecture students was Design of Mercantile Building at Noida (plot size=50m x 80m) involving all structural, landscaping, Building Electrical, Plumbing and Mechanical services.

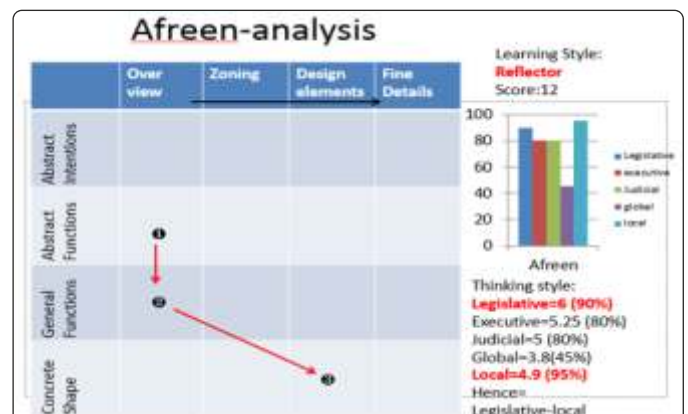


Fig 5: Sample study-Third year student and Summary of 3<sup>rd</sup> year students



Fig 6: Learning styles needed in various stages

The results show that the first year students are Mostly Reflectors in learning styles. Thinking styles are evenly scattered into legislative, executive, judicial thinking, hence can be easily molded into any styles. Pragmatists like to make their own paths hence they are legislative in thinking. Most Reflectors are also judicial thinkers and global in their scope of thinking. Mostly local thinking styles have to be trained to think globally in a parallel process. Legislative thinkers start from the left edge of the design process chart (Overview) and proceed diagonally downwards. Executive style thinker's start from the middle (overlap of overview and abstract functions) and Judicial style thinkers start from halfway between the overview and the details, in the design process.

The results of the second years was that there are equal learning styles of reflector, activist, pragmatist but no theorists. Age could be an issue since this is the exploratory age and students are generally rebels. Hence there is No clear pattern of thinking and learning styles. Mostly reflectors in learning and Judicial, also global in their thinking. Students are who are legislative thinkers, are also local thinking. Mostly Pragmatists are local thinking. Hence Students need to be trained to think globally.

In the third year students, there is a Clear pattern of having reflector- executive-local thinking dominated group. There are also some Reflector-legislative-local grps; and some Activist-executive-local grps are also present. Most students are Executive thinking with local thinking styles. In the Reflectors the students are legislative or executive thinking. There is also a Local thinking domination. Hence they have to be trained in global thinking. However there appears to be No clear connection of learning and thinking styles. It has also been observed that the Executive thinkers start from the middle of the chart here also. Local thinking end up closer to the right side ending but miss out on overview (global thinking). Hence it may be concluded that by the third year the students arrive at the clear patterns to follow while designing.

**ANALYSIS AND INTERPRETATION OF DATA:****1. Learning style and Educational Objectives****Bloom's taxonomy**

Bloom's taxonomy defines the educational objectives of the studio class and any design methodology seeks to satisfy these objectives. Basically all studio teaching, learning and results should be in these parameters of stages of knowledge gain, comprehension, Application, Analysis, Evaluation and synthesis. Domains may be thought of as categories. Instructional designers, trainers, and educators often refer to these three categories as KSA (Knowledge [cognitive], Skills [psychomotor], and Attitudes [affective]). This taxonomy of learning behaviors may be thought of as "the goals of the learning process."

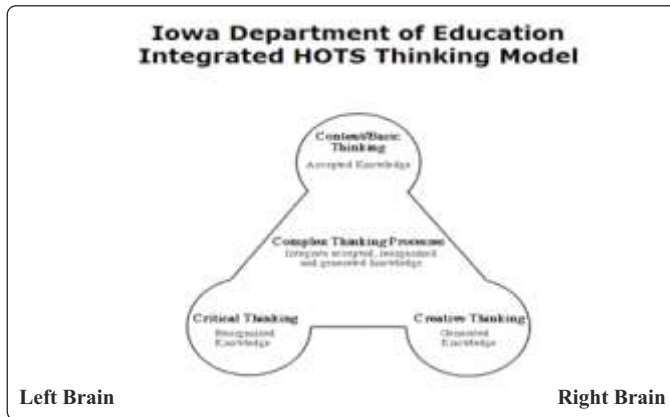
**2. Thinking Styles and Educational Objectives**

Fig 7. IOWA dept. of Education Integrated Thinking Model for design Education

Image courtesy: IOWA State Univ. website- Iowa State Univ. Deptt of Education's Integrated Higher Order Thinking Model

Basic thinking acts as a major processing mechanism in the designer's mind and as an archive of information and images, it is considered as the most important component of thinking processes during the design process. All types of information including: the experiences they have had, the environmental background of designers, images they have seen in the past, and even those new information that they seek and collect throughout a design process, are collected and processed in this stage. Basic thinking approach can be defined as being part accepted knowledge which is responsible for presenting a solution. It involves problem solving, designing, and decision making in the model of the design process (Mahmoodi, 2001)

Logical thinking is that part of the problem that warrants recognition of the problem to solve. It involves Analyzing, criticizing and comparing various things in the model.

Creative thinking- Creative thinking is defined as being of generated knowledge which is responsible for idealizing a solution (Mahmoodi, 2001). It involves Synthesizing, Elaborating and Imagining.

Synthesizing- Students need to apply some design strategies to exercise their design ideas so they can prepare a plan of work to generate ideas. Elaborating- Students need to elaborate and work on their design ideas and shift their perspectives to evolve their design. Imagining- students need to have an effortless and fluent response to the design problem. They need to visualize and imagine the solution.

**Design Intervention and experiment/Analysis of students' Design Approach**  
To analyse and study the Students learning and thinking approach to a given design problem, an intervention in the form of a submission was undertaken in the 1st year B.Arch Architecture studio at Faculty of Architecture and Ekistics, Jamia Millia Islamia, by the Author.

The Design Problem was- "Design a Personal Space in your home/part of House"

The Requirements of the submission were: Distinct zones for sleeping/storage/study/work/leisure/snack;

**Submission stage 1- for "Personal Space"**

- Make a collage of mental images or ideas you have for your personal space, with overview and details of design.
- Make a sheet of the anthropometrics needed for the design elements you will put in it- Bed, study table, recliner, storage, etc. showing all dimensions of the design elements with your own measurements.

Reasons and Justification for the collage submission:

- Knowledge:** To help the students gain knowledge: By Visuals, Examples, Illustrations, Mapping of mental images (right brain stimulants)
- Comprehension:** To help the students understand the technicalities of the Drawing: By Anthropometrics, dimensioning
- Application:** To help the students apply this knowledge and understanding: By layouts, sketches, visuals
- Analysis:** To help students analyze the work they have done with knowledge and understanding gained: By using the visuals and anthropometrics in their final design sheets
- Evaluation:** To facilitate evaluation of the design process: By the students themselves and the teachers- by making it mandatory to think on 2 levels- Global and local in each stage.

**FINDINGS AND IMPLICATIONS:**

After the design Intervention was executed, the Author took a survey from the students and faculties.

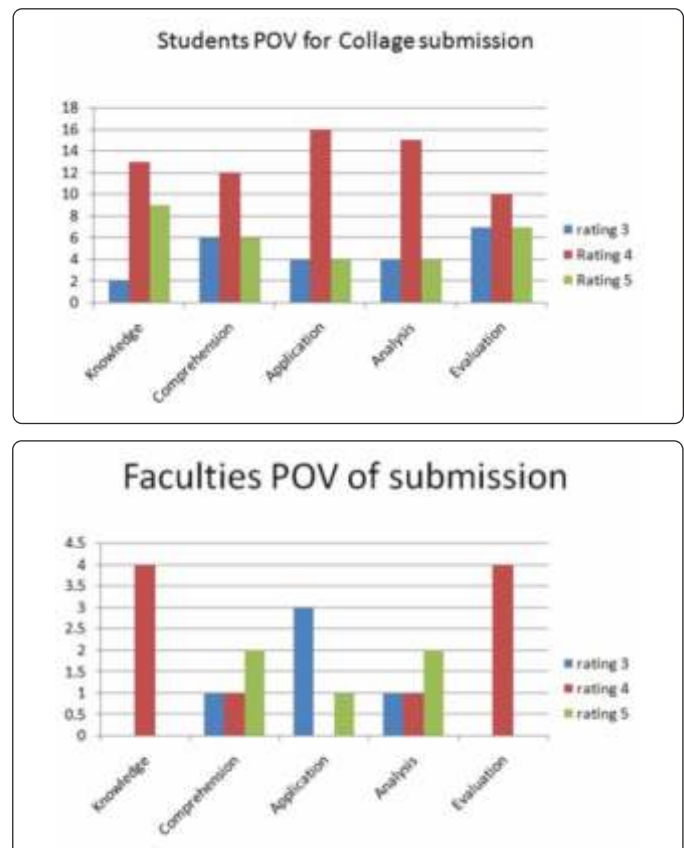


Fig 8: Students Point of view and Faculties point of view

**Observations:**

- Students welcomed the idea of mental images mapping in the form of collage making.
- Students gained a fair idea of what they wanted to do with the personal space.
- They got motivated into research about the personal spaces so available.
- They were willing to apply this exercise of collage making of mental images associated with the design again in another design problem.
- They got an understanding of the spaces so needed for the various design elements by the anthro sheets.
- They were happy to be working on 2 levels of design: Global and local as in over view and detailing in a parallel process.
- Faculties liked the collage and anthropometrics submission as it made the students gain knowledge and understanding about the design problem in a holistic and detailed manner together.
- Faculties felt that this strategy could be used in another design problem.

**CONCLUSIONS AND RECOMMENDATIONS:**

Students are the future of the Design world. If their learning and thinking styles are different it is better for the design fraternity since it will create more variety and better paradigms for the future. But it is up to the faculties to be in sync with the students so that they are able to get better output from them. Instructional Methodology should be crafted to get positive results. Results should motivate the students and stimulate their right and left brain parts equally; and not puzzle them such that they struggle to give results in the form of submissions. It has been observed that institutions are treading the time-tested path of submission types and schedules without any thought to the learning and thinking styles of the students so involved. The need of the hour is that the educators understand the abilities of the students and strategise and pool in their experience and knowledge to customize the submissions according to the class present. This may mean doing out-of-the box assignments and submissions to motivate and stimulate the students' creativity. This could also mean keeping a record of the submissions and students' work for future research. We need to make an effort to reform the way we think about teaching, beginning with a process of self-reflection. As we learn more about our own tendencies, and how they have limited us in the past, and come to understand the needs of our students, especially those who are different from us, we naturally discover more tools to meet the challenges of teaching.

**Model pedagogy techniques:**

1. *Teacher self-awareness:* The first step in this strategy is for the teacher to become aware of his/her learning types and thinking styles. It could be that certain inherent qualities of the teacher get manifested into his/her teaching styles due to personality tendencies etc.
2. *Students' Learning/thinking styles:* The entire class should be mapped on learning and thinking styles and the records should be maintained to teach and assess the students. The teacher should be aware of the students learning styles so that he/she is able to get the best work out of them and in their comfort zone. It also means that the teacher knows how to engage the class full of activists and a class full of pragmatists with some hands on work and likewise for the others. For example the teacher should try to form groups of assorted learning and thinking styles so that the work can be optimally done. This can only be done if the students' records are kept year after year and the teacher knows all his students well.
3. *Well established Pedagogical Tools:* The teacher needs to be very clear as to what are the learning objectives and where is he leading the class. This needs to be communicated to the class very effectively and clearly. All kinds of learners will truly appreciate this and in the absence of this, may interpret a teacher's inarticulateness as inefficiency. Participation of all levels is of the utmost importance. The teacher needs to give clear step by step directions to the students as to what is to be done for achieving the learning objectives. It is the deeper responsibility of the teacher to motivate the students with constant positive and negative feedback on their work.
4. *Teach across types:* since it has already been mentioned how certain thinking type of teachers can communicate better with certain similar thinking type of students, it is all the more necessary for the teacher to come out of his/her comfort zone and give full attention and respect to the other learning types without being sarcastic etc.
5. *Conditions of different types established:* It is very important for the teacher to establish the conditions of the learning and thinking types. This is important so that they get to work in their strong learning styles for at least some period of the studio class. Essentially it means doing some practical work hands on for the activists and pragmatists, working out some theories and concepts for the Reflectors and theorists, letting the legislative make his own rules in the studio, Give some analysis to the judicial and executive thinking and lastly make them all think on 2 platforms- Global and Local essentially. One idea is to give choices of activity or preferred modes of accomplishment for lessons. Another idea is to structure activities that work to the strengths of each of the types for some of the period.

**SUMMARY:**

Learning and Thinking, form the basis of all our basic day to day functions and beyond. It is therefore reasonable to understand that they spill over into our studio understanding and working in the outside world... Students of today are very evolved and coherent in their learning and thinking styles. All they need is a little direction as to which path to lead them to success. This is on the basis of their preferred learning and thinking style which is inherent in their personality and their background. If the teacher's learning style matches the students, there is better communication and rapport between them. This leads to the students doing better in their studies and a better overall class performance. Certain learning and thinking types design in a certain way and this is reflected in their design process. The results of the Author's research showed that from 1st year to 3rd year architecture students of a certain combination of learning and thinking types; design in a certain way. The majority of students are judicial in thinking when they enter college but become executive in thinking by the third year. They get conditioned to follow orders and think locally. Design is a parallel process which needs both critical and creative thinking for the best results. Hence a new approach to the diver-

sity of learning and thinking styles is the need of the hour. It has been said by the experts that to get a certain result, the instructions should be such that no other results will be possible.

However the Author admits that this is a preliminary study, one of the first kind conducted on architecture students, and researchers should conduct more extensive and elaborate investigations to map the teaching and learning in the architecture studio. The Author proposes a "Liberal Curriculum" that records teachers' submission and students' learning and thinking styles and submission responses; for the curriculum to respond and evolve according to the students' needs i.e. Learning and thinking styles. The studio submissions need to be designed in such a way that they let the different students work in their core strength learning styles and design in their core strength thinking styles for atleast apart of the studio; apart from which they need to enhance their other less dominant learning and thinking styles to work in the outside world where they will have to adapt to the changing world situations as best as they can. These pedagogical approaches will help the students to achieve their fullest potential in the future in any design criteria and circumstances.

**REFERENCES:**

1. Ali Abdi; 2012; A study on the relationship of thinking styles of students and their critical thinking skills; published by Elsevier
2. AMIR SAEID M. MAHMOODI, 2001; The Design Process In Architecture; Published for Thesis at University of Leeds, UK.
3. Ann-Louise De Boer, 2003; Thinking styles and their role in teaching and learning; Research paper published by University of Pretoria.
4. Antonio P.Volpentesta, Salvatore Ammirato, Francesco Sofo, January 2012; Thinking Style Diversity and Collaborative Design Learning; published in International Journal of Engineering Education 28(4):948 - 958; dl.ifip.org/db/conf/ifip5-5/ifip5-5-2009/VolpentestaAS09.pdf
5. Behin Forghanifar, Mojtaba Hassanzadeh, 2014; "Study of the Architectural Design Process Based on Collage Method"; ran National Architectures Guilds' Society International Conference on Architectural, Civil and Urban Development at the Beginning of the Third Millennium Month of Tir of the Iranian Solar Calendar Year 1394; www.academia.edu
6. Chuen-Tsai Sun, Dai-Yi Wang; 2011, and Yu-Yeh Chang; Effects of Thinking Style on Design Strategies: Using Bridge Construction Simulation Programs; Research undertaken for National Science Council of Republic of China
7. Donald J. Treffinger and Scott G. Isaksen; 2005; Creative Problem Solving: The History, Development, Implications for gifted education and Talent Development; Research article published in the Gifted Child Quarterly.
8. Dr. Eman Sabry Abdellatif Abo Wardah, and Dr. Manal Osama Khalil, March 26-27, 2016; Design Process & Strategic Thinking in Architecture; Paper presented in 2016 2nd International Conference on Architecture, Structure and Civil Engineering (ICASCE'16) London (UK).
9. Fathi Bashier; 2014; Reflections on architectural design education: The return of rationalism in the studio; Published in Elsevier Ltd.
10. Grigorenko, Elena L., Sternberg, Robert J; 1997.; Exceptional Children-Styles of thinking, abilities, and academic performance.; published by Council for Exceptional Children
11. Han Hee Choi, Mi Jeong Kim; 2016; THE POTENTIAL OF REASONING METHODS AS A TEACHING STRATEGY SUPPORTING STUDENTS' CREATIVE THINKING IN ARCHITECTURAL DESIGN; Published in ArchNet International Journal of Architectural research
12. Jones, J.C.; Systematic design methods and the building design process; <http://www.irbnet.de/daten/iconda/CIB15018.pdf>
13. Lueth, Patience Lamunu Opiyo, "The architectural design studio as a learning environment: a qualitative exploration of architecture design student learning experiences in design studios from first- through fourth-year" (2008). Retrospective Theses and Dissertations. Paper 15788.
14. O.O. Demirbas, and H. Demirkan; 2003; "Focus on architectural design process through learning styles"; Published by Elsevier Science Ltd
15. O.O. Demirbas, and H. Demirkan; 2007; "Learning styles of design students and the relationship of academic performance and gender in design education"; Published by Elsevier Science Ltd
16. Robert J. Sternberg, 1997; Styles of Thinking and Learning; Published by Canadian Journal of School Psychology.
17. Robert J. Sternberg, Li-fang Zhang; Styles of Thinking as a Basis of Differentiated Instruction; Published by CiteSeer; <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.499.6218&rep=rep1&type=pdf>
18. Robert J. Sternberg, 2006; The Nature of Creativity; published by Lawrence Erlbaum Associates, Inc; Creativity Research Journal, Vol. 18, No. 1, 87-98
19. Susan Montgomery, Linda Groat; 1998; Students Learning styles and their implications for teaching; Published by The Centre for Research on Learning and Training, Univ. of Michigan.
20. Salama, Ashraf M (2005) A process oriented design pedagogy: KFUPM sophomore studio. Centre for Education in the Built Environment Transactions, 2 (2). pp. 16-31. ISSN 1745-0322, 10.11120/tran.2005.02020016